Multi-drug Resistant Organisms (MDROs) in Healthcare Facilities

Gail Bennett RN, MSN, CIC

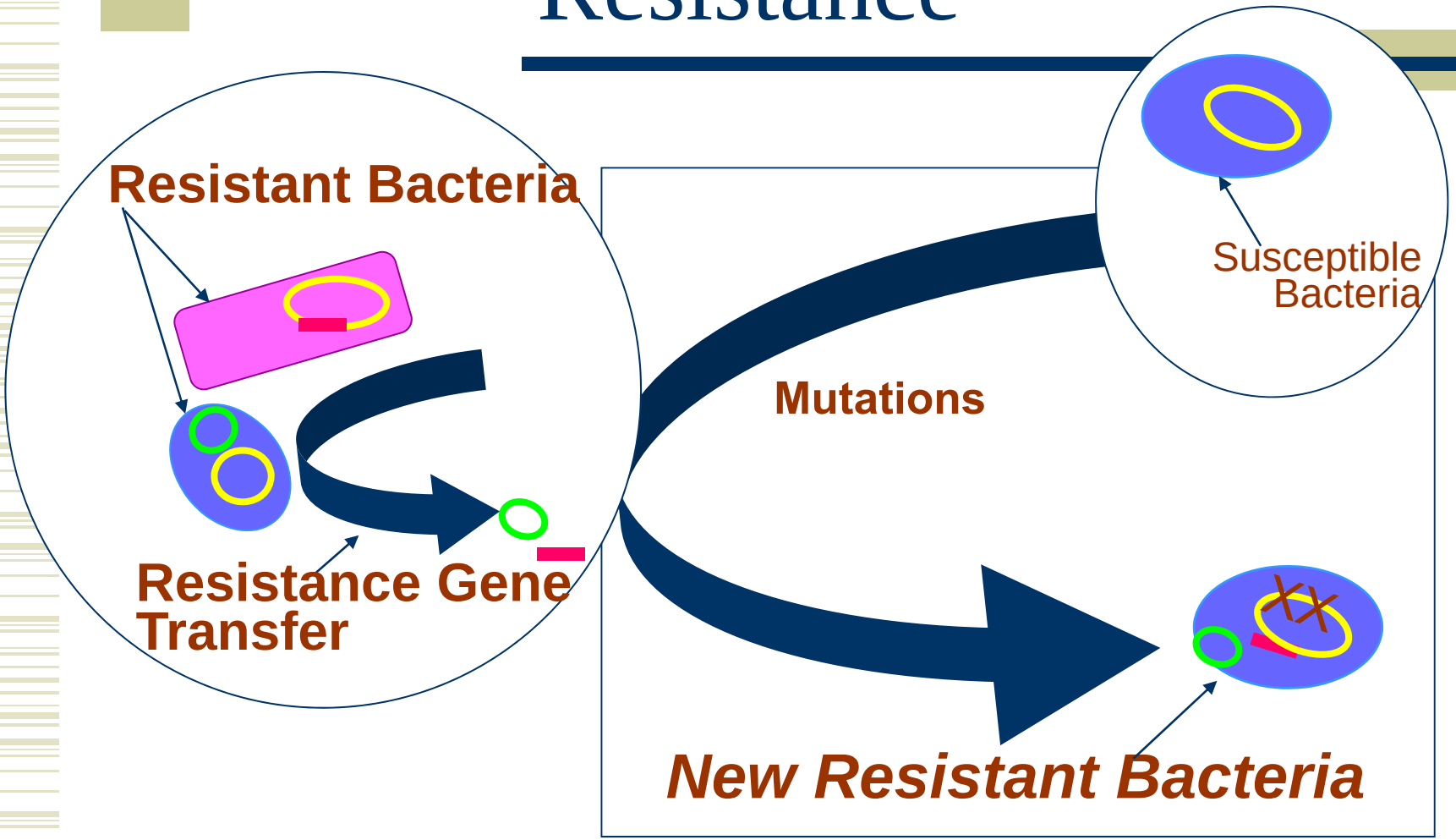
What we will cover:

- General information
- Specific MDROs
  - Methicillin Resistant *Staph aureus* (MRSA)
  - Vancomycin Resistant Enterococci (VRE)
  - Extended Spectrum Beta Lactamase Producers (ESBLs)
  - *Klebsiella pneumoniae* carbapenemase (KPC)
  - Resistant *Acinetobacter baumannii*

What we will cover:

- Surveillance for MDROs
- Control Measures
  - Isolation precautions
  - Hand hygiene
  - Environmental decontamination
  - Antimicrobial stewardship programs

Emergence of Antimicrobial Resistance



Methicillin-Resistant Staphylococcus aureus (MRSA)

- MRSA emerged in the US soon after Methicillin became commercially available in the early 1960's with the first case being detected in 1968.
- Increased prevalence in the '70s

- 2000: MRSA accounted for 53% of all S. aureus clinical isolates from patients with nosocomial infections acquired in US ICUs (NNIS)
- 2003: the percentage had increased to 59.5% (NNIS)

- The 1st identification of MRSA in LTCFs was in 1970 but it was uncommon in LTC until around 1985.

Methicillin-Resistant Staphylococcus aureus (MRSA)

- Resistant to methicillin, oxacillin, and nafcillin
- Transmitted by direct and indirect contact
- No more virulent than MSSA
- Susceptible to common disinfectants

Risk Factors Contributing to MRSA Colonization/Infection for all Facility Types

- Poor functional status
- Conditions that cause skin breakdown
- Presence of invasive devices
- Prior antimicrobial therapy
- History of colonization

Specific Risk Factors for MRSA Colonization in LTCFs

- Male gender
- Urinary incontinence
- Fecal incontinence
- Presence of wounds
- Pressure ulcers
- Antibiotic therapy
- Hospitalized within the previous 6 months

What patients are more likely to shed MRSA and need contact precautions?

- Heavy draining wound
- Incontinent, diarrhea, colostomy
- Cannot/will not contain secretions and excretions
- Very poor hygiene
- Difficult behaviors that may increase the risk of transmission
- Other

Treatment Regimens for MRSA Infection

- Vancomycin is the drug of choice
- Disadvantages of Vancomycin
  - expensive
  - parenteral administration
  - ototoxicity
  - can potentiate nephrotoxicity of aminoglycosides

Treatment Regimens for MRSA Infection

- Linezolid (Zyvox) has been an alternative to Vancomycin treatment of MRSA since 2000
- Administered orally

Colonization/carrier state of MRSA by Healthcare Workers

- Do not routinely culture staff for colonization with MRSA
- It may be needed as part of an outbreak investigation
  - HCW epidemiologic link to transmission
- Before culturing,
  - Get expert consultation
  - Have an action plan in place!

Outbreak control

- Contact precautions with observation for compliance
- Hand hygiene
- If a decision has been made to culture staff for nasal colonization: Mupirocin has been shown to be somewhat effective.

Vancomycin-resistant Staphylococcus aureus

- 1st case in US, June, 2002, Michigan; 2nd case - September, 2002, Pennsylvania
- Vancomycin resistant gene transferred from VRE in same patient
- To date, the US has had approximately 11 cases of VRSA
- CDC recommends private room, contact precautions
- Reportable to your state and CDC

Vancomycin-resistant Staphylococcus aureus

- Excellent document: CDC. Investigation and Control of Vancomycin-Intermediate and –Resistant *Staphylococcus aureus* (VISA/VRSA), September, 2006.

What about surveillance cultures to find all patients/residents colonized or infected with resistant organisms?

- Not routinely recommended for acute care, LTCFs, or other healthcare facilities
- May be needed in an outbreak
- Must have an action plan before you start culturing – I would suggest a consult with the state epidemiology office first

- Active surveillance cultures:
- CDC says, “More research is needed to determine the circumstances under which ASC are most beneficial but their use should be considered in some settings, especially if other control measures have been ineffective.”

- CDC MDRO Guideline, 2006

However, hospitals have a relatively new process for surveillance screening for MRSA - Example:

- All admits from LTCFs, jails, prisons
- Anyone on dialysis
- ICU/CCU admissions
- CABG patients
- Orthopedic patients: total joint replacements
- Neuro: open back
- Wounds/cellulitis

Are hospitals screening all admissions for MRSA?

- No, only a small % of their admissions fall in their high risk categories and get screened

So… do we isolate admissions to LTCFs from the hospital who were culture positive for MRSA in the nares?

- No, not if that is the only site of MRSA identified
- We will be alert to the fact that the resident is colonized and alert to any new healthcare associated MRSA cases should they develop

Vancomycin-Resistant Enterococcus (VRE)

- *Enterococcus faecalis*
- *Enterococcus faecium*
- Contact Precautions - culture negative prior to discontinuing precautions?
  - CDC now says we need to decide when to d/c precautions but it may be prudent to have negative culture(s) prior to d/c of isolation

Why contact precautions for specific organisms?

- Environmental contamination

The Inanimate Environment Can Facilitate Transmission

X represents VRE culture positive sites

~ Contaminated surfaces increase cross-transmission ~

Abstract: The Risk of Hand and Glove Contamination after Contact with a VRE (+) Patient Environment. Hayden M, ICAAC, 2001, Chicago, IL

Resistant Acinetobacter baumannii

- Aerobic gram-negative bacillus
- High level of resistance
- High numbers of *A. baumannii* infection among our troops in Iraq
- Causing outbreaks in healthcare facilities
- Contact Precautions
- See attached example

Acinetobacter baumannii: Example microbiology report

Antimicrobial	Interpretation	Antimicrobial	Interpretation
Polymyxin B	S	Ampicillin/ sulbactam	I
Ampicillin	R	Aztreonam	R
Cephazolin	R	Ceftriaxone	R
Trimethoprim/ Sulfa	R	Cefepime	R
Gentamicin	R	Ceftazidime	R
Tobramycin	R	Piperacillin/ tazobactam	R
Levofloxacin	R	Imipenem	R

Extended spectrum beta-lactamase producers (ESBLs)

- Gram negative organisms - *Enterobacteriaceae*
- Excrete the enzyme beta-lactamase
- Inactivates β-lactam (penicillin) type antibiotics
- Resistance to β-lactams emerged several years ago and has continued to rise
- ESBLs
  - Klebsiella
  - E. coli
  - Serratia
  - others

Urine culture - *Klebsiella pneumoniae*

Antimicrobial	Interpretation	Antimicrobial	Interpretation
Ampicillin	R	Ciprofloxacin	R
Ampicillin/ sulbactam	R	Gentamicin	S
Aztreonam	R	Imipenem	S
Cephazolin	R	Nitrofurantoin	R
Cefepime	R	Piperacillin/ tazobactam	I
Ceftazidime	R	Trimethoprim/ Sulfa	R
Ceftriaxone	R		

The Last Line of Defense

- Fortunately, our most potent β-lactam class, carbapenems, remained effective against almost all *Enterobacteriaceae*.

  Doripenem, Ertapenem, Imipenem, Meropenem

- But… Antimicrobial resistance follows antimicrobial use

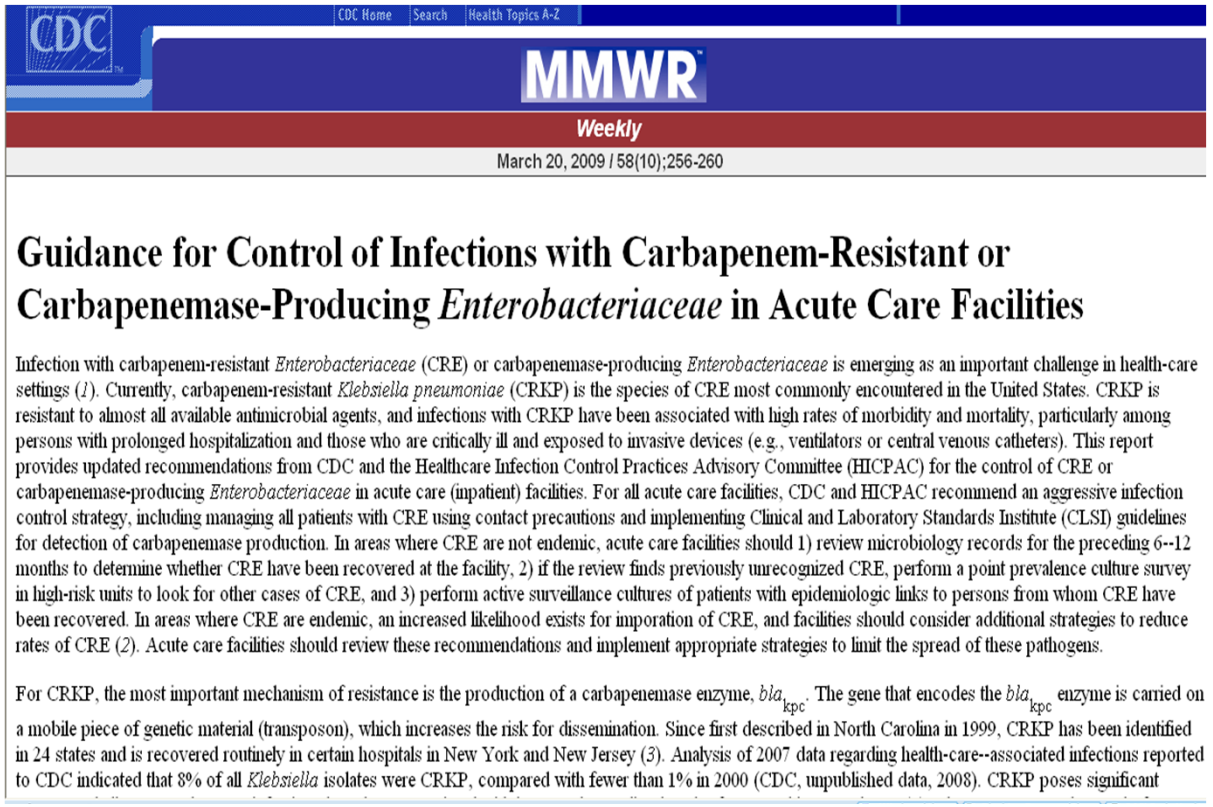
Susceptibility Profile of KPC-Producing K. pneumoniae

Antimicrobial	Interpretation	Antimicrobial	Interpretation
Amikacin	I	Chloramphenicol	R
Amox/clav	R	Ciprofloxacin	R
Ampicillin	R	Ertapenem	R
Aztreonam	R	Gentamicin	R
Cefazolin	R	Imipenem	R
Cefpodoxime	R	Meropenem	R
Cefotaxime	R	Pipercillin/Tazo	R
Cetotetan	R	Tobramycin	R
Cefoxitin	R	Trimeth/Sulfa	R
Ceftazidime	R	Polymyxin B	MIC >4µg/ml
Ceftriaxone	R	Colistin	MIC >4µg/ml
Cefepime	R	Tigecycline	S

Klebsiella pneumoniae Carbapenemase (KPC) Guideline

CDC - MMWR

March 20, 2009



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MMWR Weekly

March 20, 2009 / 58(10);256-260

Guidance for Control of Infections with Carbapenem-Resistant or Carbapenemase-Producing *Enterobacteriaceae* in Acute Care Facilities

Infection with carbapenem-resistant *Enterobacteriaceae* (CRE) or carbapenemase-producing *Enterobacteriaceae* is emerging as an important challenge in health-care settings (*1*). Currently, carbapenem-resistant *Klebsiella pneumoniae* (CRKP) is the species of CRE most commonly encountered in the United States. CRKP is resistant to almost all available antimicrobial agents, and infections with CRKP have been associated with high rates of morbidity and mortality, particularly among persons with prolonged hospitalization and those who are critically ill and exposed to invasive devices (e.g., ventilators or central venous catheters). This report provides updated recommendations from CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC) for the control of CRE or carbapenemase-producing *Enterobacteriaceae* in acute care (inpatient) facilities. For all acute care facilities, CDC and HICPAC recommend an aggressive infection control strategy, including managing all patients with CRE using contact precautions and implementing Clinical and Laboratory Standards Institute (CLSI) guidelines for detection of carbapenemase production. In areas where CRE are not endemic, acute care facilities should 1) review microbiology records for the preceding 6--12 months to determine whether CRE have been recovered at the facility, 2) if the review finds previously unrecognized CRE, perform a point prevalence culture survey in high-risk units to look for other cases of CRE, and 3) perform active surveillance cultures of patients with epidemiologic links to persons from whom CRE have been recovered. In areas where CRE are endemic, an increased likelihood exists for imporation of CRE, and facilities should consider additional strategies to reduce rates of CRE (*2*). Acute care facilities should review these recommendations and implement appropriate strategies to limit the spread of these pathogens.

For CRKP, the most important mechanism of resistance is the production of a carbapenemase enzyme, bla_{kpc}. The gene that encodes the bla_{kpc} enzyme is carried on a mobile piece of genetic material (transposon), which increases the risk for dissemination. Since first described in North Carolina in 1999, CRKP has been identified in 24 states and is recovered routinely in certain hospitals in New York and New Jersey (*3*). Analysis of 2007 data regarding health-care--associated infections reported to CDC indicated that 8% of all *Klebsiella* isolates were CRKP, compared with fewer than 1% in 2000 (CDC, unpublished data, 2008). CRKP poses significant

Management of Multidrug-Resistant Organisms In Healthcare Settings, 2006

Jane D. Siegel, MD; Emily Rhinehart, RN MPH CIC; Marguerite Jackson, PhD; Linda Chiarello. RN MS: the Healthcare Infection Control Practices Advisory Committee

Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007

Jane D. Siegel, MD; Emily Rhinehart, RN MPH CIC; Marguerite Jackson, PhD; Linda Chiarello, RN MS; the Healthcare Infection Control Practices Advisory Committee

Let’s talk about precautions for MDROs…….

Contact Precautions

- Protect HCWs from spreading microorganisms by direct or indirect contact with resident or his environment
- Prevent transmission within the facility
- Contact precautions are the most common transmission-based precaution used in the acute care setting, probably **droplet** in LTCFs
- Consider use with infections caused by MDROs (in LTCFs we must make a case by case decision)
- Consider the contaminated environment especially with C. difficile and VRE

Contact Precautions for MDROs in Acute Care

- Private room
- Contact precautions

CDC MDRO guideline, 2006

Contact Precautions for MDROs in LTCFs

- CDC tells LTCFs to consider:
  - the individual patient clinical situation
  - prevalence or incidence of MDROs in the facility

  when deciding to implement or modify contact precautions in addition to standard precautions for MDRO infected or colonized patients.

  Relatively healthy residents may need only standard precautions while ill residents and those where secretions/excretions cannot be contained may need contact precautions. CAUTION: some MDROs require contact precautions even in LTCFs!

  CDC MDRO guideline, 2006

Precautions in Ambulatory Settings

- CDC recommends standard precautions
- Remember: we always have the option of using gowns and gloves as needed even without contact precautions!

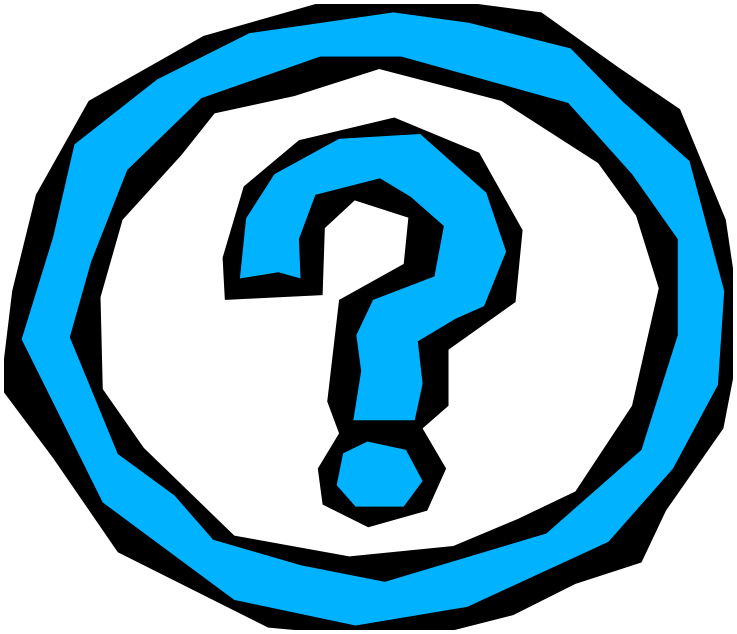
Contact Precautions

- Designed to reduce the risk of transmission of microorganisms by direct or indirect contact
- Direct contact
  - skin-to-skin contact
  - physical transfer (turning patients, bathing patients, other patient care activities)
- Indirect contact
  - Contaminated objects
  - Hands
  - Equipment
- Clothing- potential exists for contaminated clothing to transfer infectious agents to successive patients
  - New in the 2007 CDC isolation guidelines – cannot re-use same isolation gown even on same patient

Contact Precautions

- **Patient placement**
  - Private room OR
  - Cohorting (two or more patients/residents in same room with same organism) OR
  - CDC recommends that LTCFs consider the infectiousness and epidemiology of the organism to determine rooming.
    - Consult internally with management and nurse consultant if needed.
    - If roommate, should be someone low risk.

Who is a low risk roommate?



- No major wounds
- No tubes (invasive devices)
- Not otherwise immunocompromised

Contact Precautions

- Hand hygiene
- Gloves upon entering the room
- Gowns upon entering the room
- Patient/Resident socializing outside the room?
  - Consider:
    - Clean
    - Contained
    - Cooperative
    - Cognitive
- Patient-care equipment: dedicate to single patient if possible; if not – decontaminate prior to removal from the room
  - Purchase additional equipment if necessary

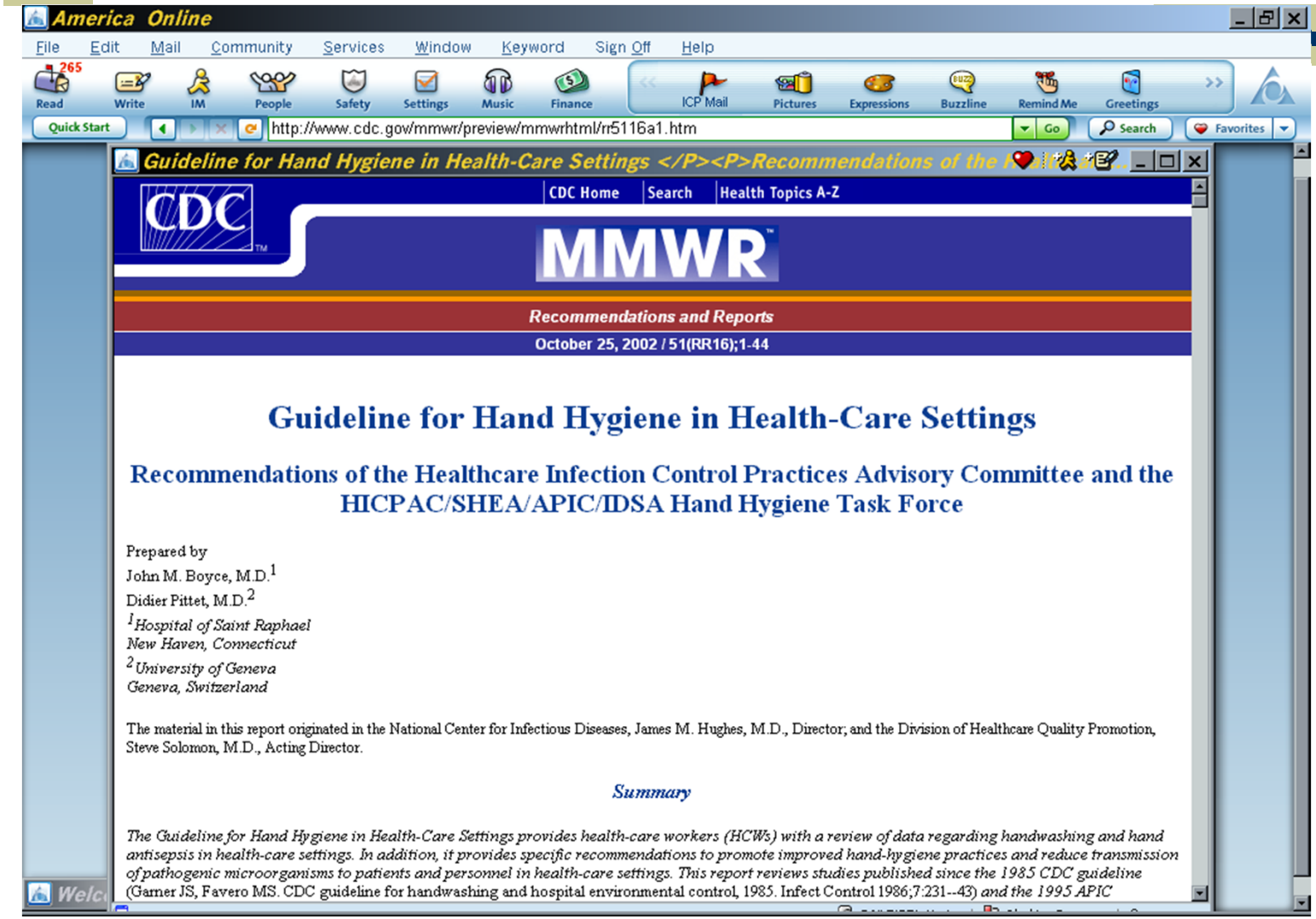
Contact Isolation

- Pediculosis (lice)
- Scabies
- Ebola
- Lassa or Marburg
- Multi-drug Resistant Organisms

Environmental Cleaning

- Use an EPA registered, hospital grade germicidal agent for environmental cleaning in clinical areas
- May consider increased frequency of cleaning in heavily soiled areas
- Identify “high touch” areas throughout the building and have them on scheduled cleaning

CDC Guideline for Hand Hygiene in Healthcare Settings (MMWR 2002, vol.51, no. RR16)



Hand Hygiene

- **CDC Guideline for Hand Hygiene**
  - **If washing with soap and water, at least 15 seconds**
  - **Soap and water for spore formers (C. diff), before eating, after bathroom**
  - **Otherwise, alcohol rubs acceptable unless hands are soiled**
  - **No requirement to wash with soap and water after so may uses of alcohol rub**
  - **Many facilities have mounted them in all patient/resident rooms**
  - **What about toxicity if swallowed?**
  - **Less abrasive to hands than soap and water**
  - **Wash after removing gloves**
  - **Fingernails - short**

Does she work at your facility?

Antibiotic Review

F441: Because of increases in MDROs, review of the use of antibiotics is a vital aspect of the infection prevention and control program.

An area of increased surveyor focus- an area where you need to assess if you are meeting the surveyor guidance

Antibiotic Monitoring and Review

- What most likely exists currently in your program:
  - Comparison of prescribed antibiotics with available susceptibility reports (charge nurse and infection preventionist)
  - Review of antibiotics prescribed to specific residents during regular medication review by consulting pharmacist
- What may be needed:
  - Antibiotic stewardship program in the facility (CDC recommendation – 2006 MDRO guideline)
  - Broader overview of antibiotic use in your facility with reporting to quality assurance/infection control committee

Right drug - Right dosage - Right monitoring - Feedback of data to MDs

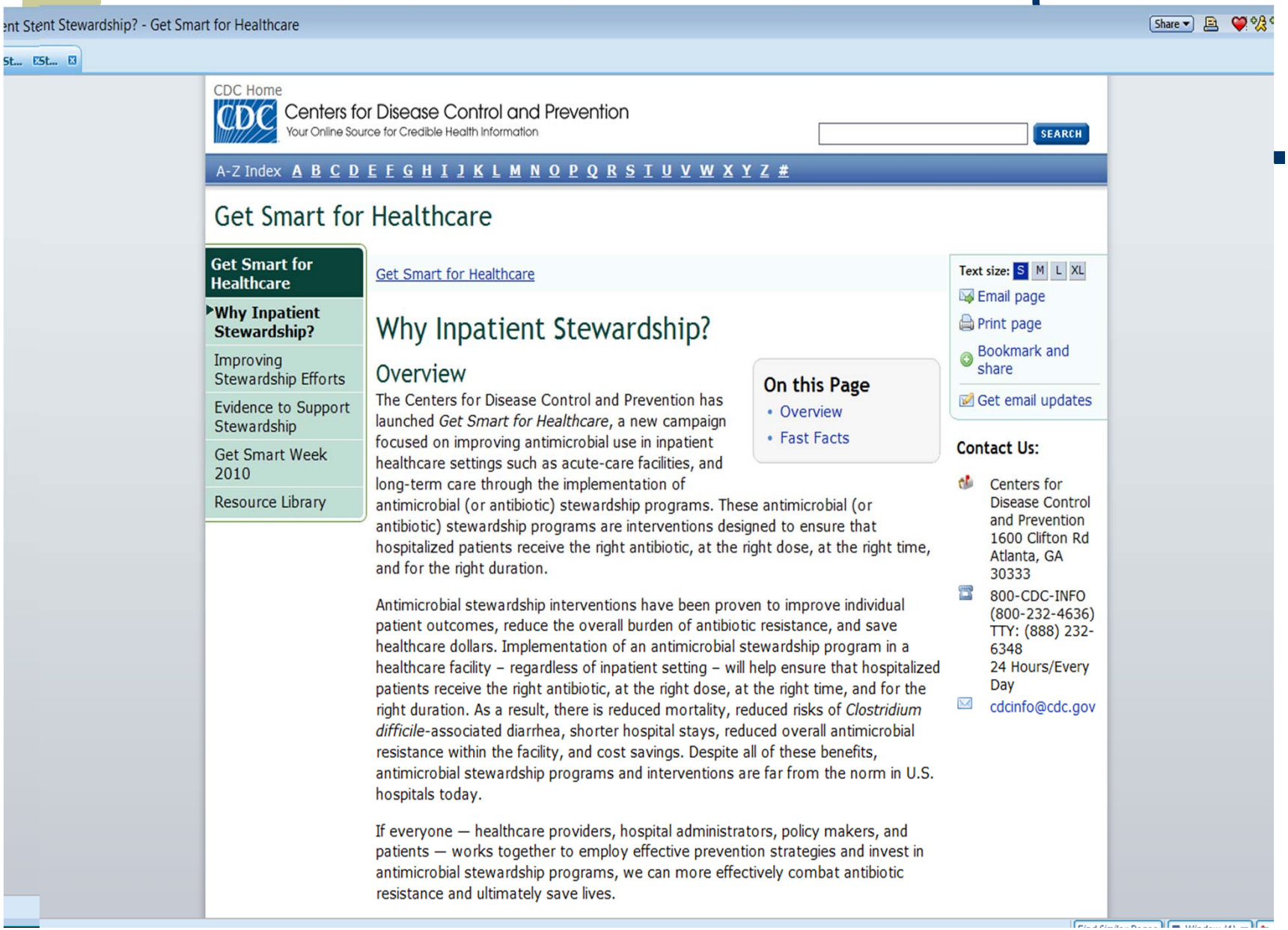
Methods to Improve Antimicrobial Use

- Prescriber education
- Standardized antimicrobial order forms
- Formulary restrictions
- Prior approval to start/continue

Methods to Improve Antimicrobial Use

- Pharmacy substitution or switch
- Multidisciplinary drug utilization evaluation (DUE)
- Provider/unit performance feedback
- Computerized decision support/on-line ordering

Antimicrobial stewardship



CDC Fast Facts

- Antibiotic overuse contributes to the growing problems of *Clostridium difficile* infection and antibiotic resistance in healthcare facilities.
- Improving antibiotic use through stewardship interventions and programs improves patient outcomes, reduces antimicrobial resistance, and saves money.
- Interventions to improve antibiotic use can be implemented in any healthcare setting—from the smallest to the largest.
- Improving antibiotic use is a medication-safety and patient-safety issue.
- http://www.cdc.gov/getsmart/healthcare/inpatient-stewardship.html

Prevention IS PRIMARY!

Protect patients…protect healthcare personnel…
promote quality healthcare!

References

- *CDC,* ***Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007*** *(HICPAC), 2007; 1-219.*
- *CDC,* ***Management of Multidrug-Resistant Organisms in Healthcare Settings,*** *2006 (HICPAC), 2006;1-74.*
- SHEA ***Guidelines for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of Staphylococcus aureus and Enterococcus*****. Infection Prevention & Hospital Epidemiology,** May 2003, pp. 362–386
- CDC, *Investigation and Control of VISA/VRSA*. A guide for health departments and infection control personnel. Updated: Sept. 2006
  - http://www.cdc.gov/ncidod/dhqp/pdf/ar/visa_vrsa_guide.pdf

Thank you!!

gailbennett@icpassociates.com